

position of the incense and again learned it was mystical material gathered in the woods nearby and he could not reveal its origin or nature. It was burned in honor of his patron, Saint Michael. It was obvious from the odor that at least one component of the incense was the gommier, *Dacryodes excelsa*, a tree which yields a resinous inflammable material. Tucked in one corner of the first room was a small cot and over it a shelf holding a few books.

My attempts to purchase one of his *Lygodium* baskets were futile, for he could not part with a "mystery." So after listening to several verses of scripture and receiving his blessing as he held one of my hands and placed his other on the top of my head, I offered him a coin for his work and departed, having learned of a symbolic use for *Lygodium micans*.

HARVARD UNIVERSITY

Pteridophytes from Two Liberian Counties

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During June and July, 1949, the writer botanized in two rather small and widely separated localities in Liberia, West Africa. One county, Montserrado, is coastal, and the other, Sanokwele, forms a part of the Liberian hinterland adjoining the French Ivory Coast. An effort was made to collect all bryophytes and pteridophytes, and also those spermatophytes in flower or fruit. This work yielded over nine hundred sheets of dried specimens representing some three hundred species.

The collections may be most logically discussed in connection with the two localities where they were made: Bushrod Island, in Montserrado County, and Sanokwele Village, in Sanokwele County.

BUSHROD ISLAND

The northwest edge of Monrovia, on the Liberian coast, is bounded by a shallow inlet of the sea, Mesurado Lagoon. A segment of the coast some three miles long is cut off by the St. Paul River, which flows into the sea four miles north of Monrovia. A shallow estuary, Stockton's Creek, connects the Mesurado Lagoon with the St. Paul River, so that this coastal segment is quite surrounded by water and has been named Bushrod Island. Its east-west dimension as established by Stockton's Creek and the coast is approximately two miles. The modern wharf and harbor facilities for Monrovia are built at the southern tip of Bushrod Island, whose nearness to Monrovia and flat, accessible character have led to rather extensive development. There are scattered plantations of rubber, cassava, and coffee, with a considerable part remaining as dense first growth forest. Some of the previously cultivated tracts have been abandoned to "bush." The island supports three large Kru villages, whose people fish, farm, or work in Monrovia.

Located at $6^{\circ} 20'$ North Latitude, three hundred miles north of the equator, Bushrod Island has an annual rainfall in the range of one hundred and fifty to two hundred inches, with heaviest monthly precipitation in June, July, and August, when forty inches of rain may sometimes be measured over a thirty day interval.

A cool sea breeze comes in during most of the year and temperatures rarely exceed 90° F. A night low is 65° F. In general, the temperature is wonderfully uniform in a range between 75° F. and 85° F. During December, January and February, there is little rainfall and the weather shows extremes of heat and cold as the Sahara-derived harmattan wind sweeps down from the north.

The soil of Bushrod Island is chiefly the washed sea sand of old beaches and coastwise bars. The topography

is characterized by low ridges alternating with swampy troughs all parallel with the western sea beach. The land elevation nowhere exceeds fifteen feet.

At the eastern side of the island by Stockton's Creek, vegetation is lush and thick with many great trees. This is gradually reduced coastward till at the beach there are widely separate stands of such shrubby forms as *Chrysobalanus*, *Heisteria*, *Chasalia*, and others. Lack of fertility seems the limiting factor, rather than salinity, since vegetation within reach of the surf spray shows no extensive halophytic modification.

The yield of ferns on Bushrod Island was comparatively poor in species, though the ones observed occurred in considerable masses. *Polypodium Phymatodes* L. (no. 196) formed extensive colonies in the sand within a stone's throw of the surf. While it grew well in open exposed sites, it reached a maximum of luxuriance in the half-shade of beach shrubs. Though usually an epiphyte, this species is strictly terrestrial on Bushrod Island.

Trichomanes cuspidatum Willd. (no. 222) was collected as an epiphyte on large tree trunks among the mossy growth on the half-shaded parts. Such *Trichomanes*-bearing trees were observed along estuarine runs rather than at the seaward side of the island.

Acrostichum aureum L. formed brakes six feet high at the edge of Mesurado Lagoon. This great salt water fern does best in the full sunlight and was found in open spaces together with great stands of *Avicennia nitida* Jacq.

A hundred yards east of the beach and extending to Stockton's Creek, the two most abundant pteridophytes are *Pteridium aquilinum* (L.) Kuhn (no. 17) and *Selaginella myosurus* (Swartz) Alston (no. 18). The *Pteridium* forms thickets in the mixed sand and humus of open places. It characterizes cutover areas which have been neglected. Forest clearing is progressing towards

Stockton's Creek, and it is on the seaward side of the still remaining forest that *Pteridium* is most abundant. *Selaginella myosurus* is one of the most common of Liberian pteridophytes. Except on the immediate beach, it is everywhere present over Bushrod Island as a delicate overgrowth on other plants or as a ground cover. The collector notices considerable variation in shade of leaf in a range from light green to bluish green. Frequently root connections of this *Selaginella* seem very tenuous, with the growth appearing partly or completely epiphytic.

SANOKWELE COUNTY

The second collecting region centered in Sanokwele County on the Liberian inland frontier. Climatological data for the region are wanting, but relative to the coastal regions precipitation is less than one half as great, with the dry season somewhat longer and more severe. Humidity is less than that along the coast but temperature variations are essentially the same. The soil is a uniform red laterite containing oxides of aluminum, silicon, iron, and calcium; it is of extremely variable fertility. The terrain is pleasantly rolling and dissected by many streams usually trending westward toward the coast. The mountains in the frontier regions reach elevations of nearly 5000 feet and are forested to near the summit, where the naked sandstone may sometimes be seen. The ground elevation about Sanokwele Village is approximately fifteen hundred feet.

The vegetable cover in Sanokwele has been extensively altered by the upland rice farming of the dense native population. The primal forest cover in Sanokwele has been largely cut or burned away to make clearings for rice culture. The land use is a very wasteful one, since the natives crop a piece of land only once in seven years. In the interim, a characteristic invasive "bush" growth takes over. It is this "bush" which determines the

landscape character in Sanokwele. Along steep runs, on mountain sides and other inaccessible places, the original forest cover remains. On the sides of the higher mountains increased precipitation has led to typical rain forest associations. A botanist in Sanokwele collects chiefly by wandering over the myriad native trails which interlace the whole region.

The most conspicuous and first collected pteridophytes are the epiphytic members. Of these *Nephrolepis biserrata* (Swartz) Schott (nos. 60, 84) is the most abundant. It grows luxuriantly on the shaggy trunk of the oil palm, *Elaeis guineensis* Jacq., where the stiff persisting leaf bases offer good humus reservoirs. Since the oil palm is usually spared by the natives in their clearing operations, and since most specimens are invested with *Nephrolepis*, this is one of the most common of Liberian ferns. Other epiphytes are *Oleandra neriiformis* Cav. (no. 58) and *Drynaria Laurentii* (Christ) Hieron. (no. 25). The leathery simple leaves and woody twining stems of *Oleandra* make a much more figlike than fernlike appearance. Though uncommon, *Oleandra* makes a fiercely vigorous growth where it does occur. Frequently the supporting tree trunk is invisible. The highly dimorphic fronds of *Drynaria* were the largest plant specimens taken.

Lygodium scandens (L.) Swartz (no. 32) scarcely qualifies as an epiphyte since it rarely ascends higher than six feet. It usually scrambles over herbaceous plants or low shrubs in the half shade of forest margins where its light green succulent leaves are most attractive. *Gleichenia linearis* (Burm.) Clarke (no. 149) is also of scandent habit and grows sporadically along steep trail-sides or creek banks.

In the Sanokwele countryside most pteridophytes are found in hollows between low hills. Such depressions at their lowest part are commonly swampy swales. Here

there are zones of more constant moisture and richer humus accumulation as well as partial shade. Species collected about the margin of swales are *Lycopodium cernuum* L. (nos. 33, 44), *Dryopteris striata* (Schum.) C. Chr. (no. 28), *Pityrogramma calomelanos* (L.) Link (no. 148), *Polypodium polycarpum* Cav. (no. 41), *Nephrolepis cordifolia* (L.) Presl (no. 143) and *Pteris spinulifera* Schum. (no. 83).

A fern of remarkable habit and habitat was encountered in *Bolbitis Heudelotii* (Bory) Ching (no. 84), on submersed rocks in a swiftly flowing stream, its rhizomes being closely appressed to the seams in the downstream face of the rocks. The fronds are dark green and leathery.

As at the coast, *Selaginella myosurus* (Swartz) Alston (no. 94) was a most abundant element. The only other form common to coast and upland is *Pteridium aquilinum*, which rapidly establishes itself in abandoned rice fields. Tiny *Selaginella subcordata* A. Br. (no. 77) made a mosslike growth on the bare clay of trailsides.

Two mountain trips were made during the stay in Sanokwele. The first included an examination of Sopea Mountain, which has an elevation of approximately three thousand feet and is characterized by a naked domelike sandstone summit. A typical rain forest extends up the mountain to end abruptly at the exposed sandstone, which rises a few hundred feet higher to form the mountain top. *Dryopteris protensa* (Afzel.) C. Chr. (no. 126) and *Pellaea Doniana* Hook. (no. 123) grew in moist humus at the mountain base. These species were only weakly lighted under the dense, reeking forest cover. Somewhat higher on the mountain but still in the forested zone, great mossy boulders lay about. These were covered with thick growth of *Asplenium Dregeanum* Kunze (no. 116), *Asplenium formosum* Willd. (no. 118), *Vittaria guineensis* Desv. (no. 117), and *Selaginella ca-*

thedrifolia Spring (no. 131). At the very top of Sopea Mountain in a slight depression in the sandstone grew a remarkable clone of *Nephrolepis cordifolia* (L.) Presl (no. 110), with the fronds all stiffly upright and oriented in ranks with almost military precision.

The second mountain explored lies near the French Guinea frontier and rises to a height of over four thousand feet. It is called Billi Mountain or Bobei Mountain, after Bobei Village near its base. Though the forest cover is dense and primal with near-rain-forest precipitation, few pteridophytes were collected. *Dryopteris protensa* var. *speciosa* (Mett.) C. Chr. (no. 164) grew in the comparatively bare humus near the mountain base. *Selaginella versicolor* Spring (no. 163) and *Selaginella Vogelii* Spring (no. 165) were found in the same habitat.

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Sand Hill Ferns of Henderson County, Texas

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The central or sand hill portion of Henderson County, Texas, consists of an area of undulating hills of the coastal plain formation. This region is degraded by many branching, spring-fed streams, which serve, where the streamside forest synusia is closed, as estival and autumnal fern habitats, when surrounding counties are dry and non-productive. The county is in east-central Texas, bounded on the east by the Neches River and on the west by the Trinity River. The sand hills (located